Claims

What is claimed is:

1. An optical isolation device for transmitting power and signals between a local source circuit and a remote isolated circuit, the optical isolation device comprising:

a light source for generating light;

an optical channel having a first end on which the light impinges and a second end optically coupled to the first end;

an opto-electrical detector adjacent the second end producing electrical power when impinged upon by the light;

an optical signal generator powered by the electrical power generated by the opto-electrical detector and coupled to a remote isolated circuit, the optical signal generator generating optical signals in response to input provided by the remote isolated circuit, the optical signals impinging upon the second end of the optical channel;

a opto-electrical sensor adjacent the first end of the optical channel generating electrical signals in response to the optical signals; and

wherein the light and optical signals are both propagated through the optical channel.

2. The apparatus of claim 1 wherein the optical channel includes a fiber optic filament.

3. The apparatus of claim 1 and further comprising a controller coupled to the light source and optical signal generator controlling the generation of the light and optical signals.

4. The apparatus of claim 2 and further comprising a lens adjacent the second end of the optical channel, the lens refracting both the optical signal and the light.

5. The apparatus of claim 1 wherein the opto-electrical detector includes a photovoltaic cell.

6. The apparatus of claim 1 wherein the opto-electrical detector includes an array of photonic devices.

7. The apparatus of claim 6 wherein the photonic devices are photovoltaic cells.

8. The apparatus of claim 7 and further comprising a lens adjacent the second end of the optical channel, the lens refracting both the optical signal and the light.

9. The apparatus of claim 3 wherein the controller induces the light source to generate light in pulses having an on time and an off time and induces the optical signal generator to generate optical signals during the off time of the light.

10. The apparatus of claim 9 and also comprising an electrical storage device electrically coupled to the opto-electrical detector.

11. The apparatus of claim 1 wherein the intensity of the light source and the sensitivity of the opto-electrical detector are sufficient to satisfy the power needs of the remote isolated circuit and optical signal generator.

12. The apparatus of claim 1 wherein the light source generates light in a bandwidth centered about a first frequency, the opto-electrical detector is sensitive in a bandwidth including the first frequency, the optical signal generator generates optical signals in a bandwidth centered about a second frequency, and the opto-electrical sensor is sensitive in a band width including the second frequency.

13. The apparatus of claim 12 wherein the light source generates monochromatic light.

14. The apparatus of claim 13 wherein the opto-electrical sensor is not sensitive to the monochromatic light.

15. The apparatus of claim 12 wherein the opto-electrical sensor is not sensitive to light in the bandwidth centered about the first frequency.

16. The apparatus of claim 12 wherein the light source is a laser.

17. The apparatus of claim 16 wherein the laser is a semiconductor laser.

18. The apparatus of claim 16 wherein the optical signal generator includes a light emitting diode.

19. The apparatus of claim 12 wherein the light source has a narrow bandwidth.

20. An opto-electric device comprising

a first circuit including a first light source;

a second circuit including a second light source and a photovoltaic cell configured to provide energy to at least a portion of the second circuit; and

a fiber optic line optically coupled to the first and second circuits, light from the first light source being transmittable to the photovoltaic cell over the fiber optic line, and light from the second light source being transmittable to the first circuit over the fiber optic line.

21. The device of claim 20, wherein the first light source periodically changes between an on state and an off state and light from the second light source is receivable by the first circuit when the first light source is in the off state.

22. The device of claim 21, wherein light from the second light source provides feedback to the first circuit regarding a condition in the second circuit.

23. The device of claim 21, wherein the second light source has an on state and an off state and the first circuit includes a detector configured to detect the state of the second light source when the first light source is in the off state.

24. The device of claim 20, wherein light from the first light source has a higher intensity than light from the second light source.

25. The device of claim 20, further comprising a storage device and the photovoltaic cell provides energy to the storage device.

26. The device of claim 25, wherein the storage device comprises a battery.

27. The device of claim 25, wherein the storage device comprises a capacitor.

28. The device of claim 20, further comprising a lens positioned adjacent an end of the fiber optic line so that light from the first light source passes through the lens prior to reaching the photovoltaic cell.

29. The device of claim 28, wherein the lens is configured to disperse the light from the first light source.

30. The device of claim 28, wherein the second light source is positioned to lie between the lens and the photovoltaic cell.

31. The device of claim 20, wherein the fiber optic line includes a single fiber optic strand.

32. The device of claim 20, wherein the fiber optic line includes plural fiber optic strands.

33. An opto-electric device, comprising:

a first circuit including a first light source;

a second circuit including a second light source and a photovoltaic cell configured to provide energy to at least a portion of the second circuit; and

a first optical channel optically coupled to the first and second circuits, light from the first light source being transmittable to the photovoltaic cell over the optical channel.

34. The device of claim 33, wherein the first light source periodically changes between an on state and an off state and light from the second light source is receivable by the first circuit when the first light source is in the off state.

35. The device of claim 34, wherein light from the second light source provides feedback to the first circuit regarding a condition in the second circuit.

36. The device of claim 34, wherein the second light source has an on state and an off state and the first circuit includes a detector configured to detect the state of the second light source when the first light source is in the off state.

37. The device of claim 33, wherein the second circuit further comprises a storage device, and the photovoltaic cell provides energy to the storage device.

38. The device of claim 37, wherein the storage device comprises a battery.

39. The device of claim 37, wherein the storage device comprises a capacitor.

40. The device of claim 33, further comprising a lens positioned adjacent an end of the first optical channel so that light from the first light source passes through the lens prior to reaching the photovoltaic cell.

41. The device of claim 40, wherein the lens is configured to disperse the light from the first light source.

42. The device of claim 40, wherein the second light source is positioned to lie between the lens and the photovoltaic cell.

43. The device of claim 33, wherein the first optical channel includes a single fiber optic strand.

44. The device of claim 33, wherein the first optical channel includes plural fiber optic strands.

45. The device of claim 33, further including a second optical channel optically coupled to the first and second circuits, light from the second light source being transmittable over the second optical channel.

46. The device of claim 45, wherein light from the second light source provides feedback to the first circuit regarding a condition in the second circuit.

47. The device of claim 46, wherein the second circuit further comprises a storage device, and the photovoltaic cell provides energy to the storage device.

48. The device of claim 47, wherein the storage device comprises a battery.

49. The device of claim 47, wherein the storage device comprises a capacitor.

50. The device of claim 45, further comprising a lens positioned adjacent an end of the first optical channel so that light from the first light source passes through the lens prior to reaching the photovoltaic cell.

51. The device of claim 50, wherein the lens is configured to disperse the light from the first light source.

52. The device of claim 33, wherein the first optical channel comprises:

a first region optically coupling the first light source to the photovoltaic cell; and

a second region optically coupling the second light source to the first circuit.

53. The device of claim 52, further comprising an isolation layer interposed between the first and second regions, the isolation layer preventing optical communication between the first and second regions.

54. The device of claim 53, wherein the isolation layer is an optically non-transparent material.

55. The device of claim 53, wherein the isolation layer has an impedance mismatch with the first and second regions whereby optical communication between the first and second regions is prevented.

56. The device of claim 53, wherein light from the second light source provides feedback to the first circuit regarding a condition in the second circuit.

57. The device of claim 56, wherein the second circuit further comprises a storage device, and the photovoltaic cell provides energy to the storage device.

58. The device of claim 57, wherein the storage device comprises a battery.

59. The device of claim 57, wherein the storage device comprises a capacitor.

60. A method of electrically isolating a remote circuit from a source circuit, the method comprising the steps of:

generating a first light signal in the source circuit;

optically coupling the first light signal to the source circuit so that the remote circuit receives the first light signal from the source circuit;

generating power in the remote circuit from the first light signal received by the remote circuit;

powering the remote circuit by the generated power;

generating a second light signal in the remote circuit; and

optically coupling the second light signal to the source circuit so that the source circuit receives the second light signal from the remote circuit.

61. The method of claim 60, wherein power is generated by the first light signal impinging a photovoltaic cell in the remote circuit.

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22 62. The method of claim 60, wherein the first and second light signals are optically coupled over a single optical channel.

23 63. The method of claim 62, 22 further comprising the step of communicating the first light signal and the second light signal in a half-duplex mode.

64. The method of claim 63, wherein the step of communication the first and second light signals in half-duplex mode comprises the steps of:

communicating the first light signal according to a duty cycle having an on state and an off state; and

communicating the second light signal during the off state of the duty cycle.

25 65. The method of claim 62, 22 further comprising the step of communicating the first light signal and second light signal in full-duplex mode.

66. The method of claim 65, wherein the step of communicating the first and second light signals in full-duplex mode comprises the steps of:

selecting a first frequency for the first light source;

selecting a second frequency for the second light source, the second frequency not equal to the first frequency;

selecting a photovoltaic cell responsive to the first frequency; and

selecting an opto-electrical sensor responsive to the second frequency.

67. The method of claim 60, wherein the first light signal is communicated over a first optical channel and the second light signal is communicated over a second optical channel.

68. The method of claim 67, wherein the first and second light signals are communicated in a full-duplex mode.

69. The method of claim 68, further comprising the step of optically shielding the first and second optical channels whereby optical communication between the first and second optical channels is prevented.